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Impact of Great Blue Heron Depredations on Channel Catfish Farms

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Abstract

With the growth of channel catfish *Ictalurus punctatus* production in the Delta Region of Mississippi over the last 30 years have come concurrent depredation problems caused by great blue herons *Ardea herodias*. Biomass in stomachs from herons collected at catfish farms averaged 41% catfish, 38% sunfish *Lepomis sp.*, 17% shad *Dorosoma cepedianum*, and 4% gambusia *Gambusia sp.*; whereas observations of herons foraging indicated that 45% of the prey taken were gambusia. Our observational data indicate that herons take an average of 12 10-cm catfish fingerlings daily. The diurnal density of foraging herons on catfish ponds averaged 0.17 herons/ha in 1990, which means that the average 127-ha farm supports approximately 22 herons. Nocturnal foraging, especially on dark nights, appears to be minimal. If our data are approximately correct, the average catfish farm could be losing $30/ha per yr to herons, assuming that this catfish fingerling mortality can be attributed solely to heron depredation.

Heron depredations have long been a bane of aquaculturists both in Europe where the grey heron *Ardea cinerea* resides and in the United States where the great blue heron occurs (Cottam and Uhler 1936; Draulans 1988; European Inland Fisheries Advisory Commission 1988). With the growth of the channel catfish industry in the Delta Region of Mississippi, USA (hereafter referred to as "the Delta") in the last 30 yr have come concurrent problems with heron depredations, problems caused by double-crested cormorants *Phalacrocorax auritus* and, to a much lesser extent, great egrets *Casmerodius albus* (Stickley and Andrews 1989). The extent and severity of the cormorant depredations to channel catfish farms in the Delta has been addressed (Stickley et al. 1992). The purpose of this paper is to document and quantify heron depredations in the same region.

Materials and Methods

Heron Censuses and Observations—Diurnal

Censuses and observations were made of great blue herons in 1989 and 1990 on catfish pond complexes in Humphreys County, Mississippi, which at that time were the source of a majority of the bird depredation complaints from catfish growers. The research was conducted between June and December in these years because cormorant harassment patrols by growers would have disrupted our efforts in the other months. For sampling purposes, the complexes were stratified into three size categories in the randomly drawn samples to guarantee the representation of less numerous large complexes. Any one of these large complexes would be more likely to have herons present at any given time than a small complex. Complexes in Humphreys County ranged in size from 37 to 269 ha and averaged 91 ha (SD = 55.9).

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Heron censuses on the 19 randomly chosen complexes were made every 3 h beginning at daylight and ending at dusk. The study area on each complex was restricted to a size that could be censused in 40 min. The census consisted of counting all herons seen on a complex while driving the levees. Each complex was censused from three times to seven times (mean = 4.6 censuses; SD = 1.1) during the 2-yr census period.

Between censuses the observer, using a vehicle as a blind, recorded the feeding behavior of individual herons on the complex. Individual birds were chosen on a first sighted basis. Only one bird was observed at a time through a 20× spotting scope. When the bird flew or disappeared from view, the observer selected the next bird spotted. Feeding behavior records for each heron included the observation period start and stop times, the prey species, its length, and whether it was taken alive or dead. We estimated prey length by comparing it with the distance between the tip of the heron's bill and the eye—approximately 18 cm. We later converted these length data to weight (biomass) data using species-specific length-to-weight equations (Anderson 1980; Steeby et al. 1991). Because of the great variation in both fish species taken and the number of fish caught between complexes, we gave each complex equal weight in calculating the mean diet. This was done to prevent a few complexes where we observed large numbers of fish caught from having undue influence.

The lengths of time we observed individual herons during unbroken diurnal observation periods varied from 1 min to 4.6 h. The average observation length was 33 min (SD = 35). We continuously observed eight herons for 2 h or more each. Observations of diurnal feeding activity occupied 221 person hours.

Heron Censuses and Observations—Nocturnal

From 1989 through 1992, we made nocturnal censuses on 57 randomly chosen complexes in Humphreys County. We conducted the censuses in every month of the year except July, and, over the course of the study, we nonrandomly sampled all hours of the night. We conducted the nocturnal censuses in the same manner as the diurnal ones except that we generally made only one census per complex. However, to gain additional information on activity patterns, we censused eight complexes that normally had nocturnal heron activity an additional one to eight times during the study.

We used a third generation night vision device (NVD) (King and King 1994) to conduct all censuses except for the first one in which we used night vision goggles. During the first part of the study, we attached the NVD to 150 and 300 mm telephoto lenses accompanied by a 400,000 candle-power Q-beam with a red filter. Later, we used a 1,280 mm F/5.6 (40×) catadioptric telephoto lens with the NVD (King and King 1994). We conducted the censuses by driving a vehicle equipped with red-filtered fog lights over the pond levees and searching the banks of each pond for herons with the NVD. We made all the nocturnal observations of feeding behavior (9.8 person-h) on three nonrandomly chosen complexes because of difficulties in locating birds on randomly chosen ones.

Heron Collections

We examined the stomach contents of 124 herons shot under depredation permits in nonrandom but scattered locations throughout the Delta. Most of these birds were collected during daylight hours from 12 catfish complexes with heron depredation problems during the summer and fall months in 1988 through 1990. Thirteen of the total 124 birds were collected under nocturnal conditions from three complexes.

We recorded the total lengths of all fish found in the stomachs. In cases where the fish were partially digested, we based the putative length on comparisons with other body measurements. We also found small amounts of unidentifiable or unmeasurable

TABLE 2. *Fish species percentages observed taken by great blue herons and found in heron stomach contents in the Delta Region of Mississippi, 1989–1992.*

	Observed[a]							Stomach contents[b]					
Species	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jul	Aug	Sep	Oct	Nov	Dec
Catfish	3	0	20	79	75	71	3	40	18	19	67	56	100
Gambusia	9	63	72	4	25	29	96	0	1	0	16	0	0
Sunfish	73	7	6	17	0	0	1	60	74	16	17	44	0
Shad	0	30	1	0	0	0	0	0	7	65	0	0	0
Carp	15	0	1	0	0	0	0	0	0	0	0	0	0

[a] Percentage of 326 live fish taken.
[b] Percent by weight of stomach contents.

identifiable fish were collected from July through December, but could not be associated with the specific time of day collected.

The breakdown by month of the percentage of fish species in the stomach samples of herons indicates that catfish was the predominant species in October, November and December (Table 2). Sunfish predominated in July and August, and were also a large component of the diet in November. At one complex herons were collected both in summer and in fall. In November 1988, stomach contents of 4 herons at this complex consisted of 73% catfish and 27% sunfish by weight. However, contents of 18 herons collected at the same complex in July and August 1989 comprised 10% catfish, 83% sunfish, and 7% shad.

Catfish consumed were, with one exception, stocker-sized fish ranging from 5.7 cm to 20.3 cm, with a mean of 10.6 cm (SD = 4.5, $N = 71$). The exception was a 26.7-cm long catfish. (The weight of a 10.6-cm long catfish would average 9.9 g [Brunson 1991a]).

The only other prey identified in the stomach contents were crayfish *Procambarus sp.*, occurring in three samples, and insects. Insects occurred in 27% of 104 herons that had at least some identifiable prey in the stomach. The few insects identified in these samples included grasshoppers *Locustidae* and dragonflies *Aeschnidae*. In comparison, 76% of these birds had fish remains and 33% had fish remains that could be identified as catfish.

Heron Density and Activity

For the 19 randomly selected complexes, diurnal censuses of herons revealed densities that varied from 0.02 to 0.45 bird/ha and averaged 0.17 herons/ha (SD = 0.11). Diurnal activity/density peaked at dawn or shortly thereafter, at 1500 h, and again just before dusk (1800–2000 h, Fig. 1).

Nocturnal censuses revealed 0.06 heron/ha (SD = 0.19) under moonlit conditions. We observed herons almost exclusively between 1800 and 0100 h with no birds observed between 0200 and 0600 h (Fig. 1). The greatest concentration of herons under nocturnal conditions was found in the first hour of darkness (between 1800 and 1900 h). In contrast to the 0.06 herons/ha we observed under a full moon, we observed only 0.01 herons/ha on dark nights.

Discussion

Catfish was the most common fish species taken by herons in terms of calculated weight

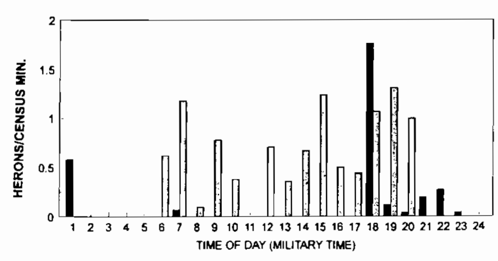

FIGURE 1. *Distribution of heron diurnal and nocturnal activity over 24-h periods on catfish complexes in the Mississippi Delta, 1989–1992. Nocturnal activity occurring at 0700, 1800, 1900, and 2000 h was recorded during winter months.*

tions at catfish complexes in the Delta Region of Mississippi is known. Other information needed to assess the overall impact of herons would be the possible losses caused by killing or wounding fish that are not consumed and the possibility of herons acting as vectors of fish diseases. Further studies under controlled experimental conditions are needed to address these questions.

This study indicates that herons prefer smaller-sized fingerlings (11 cm [4 inches]) than are generally recommended for stocking (Wellborn 1987). Thus, heron predation may be largely restricted to fingerling ponds. However, growers experiencing heron predation at food fish ponds would be wise to stock larger fingerlings in these ponds that exceed 11 cm in length.

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